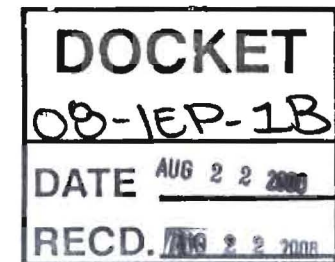


# Deploy Gigawatts of Clean, Fast, and Deep Storage for California by 2020



IEPR Workshop, August 21<sup>st</sup> 2008

Presented by  
Edward Cazalet, PhD  
MegaWatt Storage Farms, Inc.

# July 31<sup>st</sup> IEPR Workshop on Emerging Technologies for the Integration of Renewables

- CEC staff & EPRI strongly support storage for multiple benefits including renewables integration.
- NAS batteries (incorrectly) described as small, limited production, expensive, and dangerous.

# Purposes of this Presentation

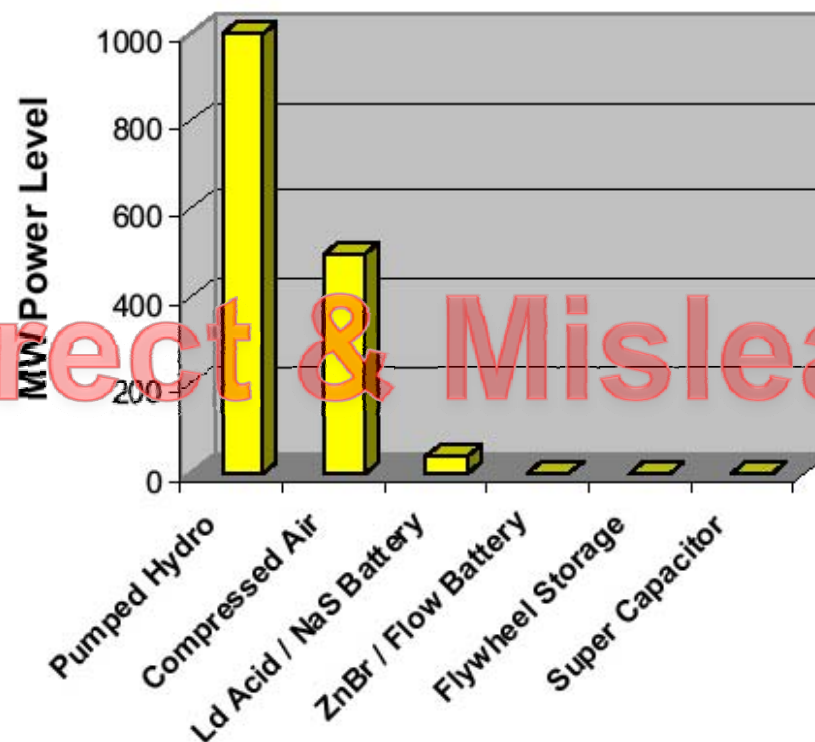
- Correct the IEPR Workshop record on NAS battery storage.
- Provide evidence that NAS is proven, available now in volume, economic and safe.
- Advocate that 2 to 3 gigawatts of clean, fast, deep storage be deployed in California by 2020.

Real Facts: NAS Batteries are 1 or 2 MW per unit  
: 500 MW of NAS within 5 years is Available

## MW Capability Of Energy Storage Plants (In Next Five Years)



MW Power Scale Per "Module" For Energy Storage Plant Types



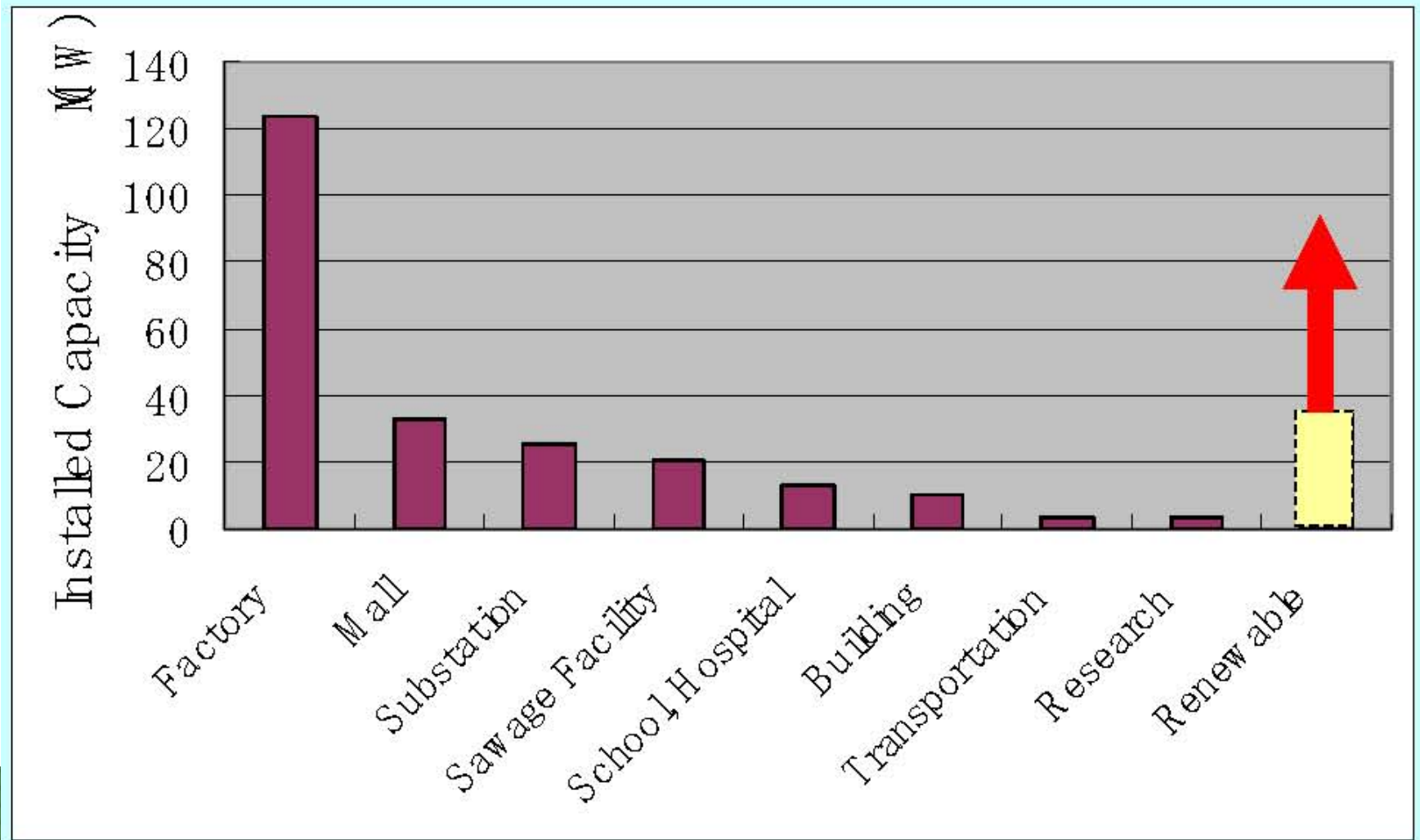
Incorrect & Misleading



# 34 MW of NAS for 7 hrs at a Japan Wind Farm



> 280 MW x 7 hrs on Grid in Japan Now



# 8 MW NAS at Hitachi in Japan (2004)



Site above is what a “California Renewables Storage Park” could look like.

Imagine 100s of Renewables Storage Parks at industrial and commercially zoned sites in California urban areas for renewables integration, local reliability and transmission investment and transmission loss savings.



# AEP 2 MW NAS on Distribution Grid





# NAS Factory at 90 MW per year (built 2003) Expanding to 160 MW per year

New Firing Kiln  
In Nagoya



Beta Alumina -  
Alpha Alumina Bonding



**Komaki Plant**

Production Capacity : 65MW/Yr.  
6000 sq.m Factory + 1000 sq.m Warehouse  
Land Space for 200MW is Available for  
Future Expansion

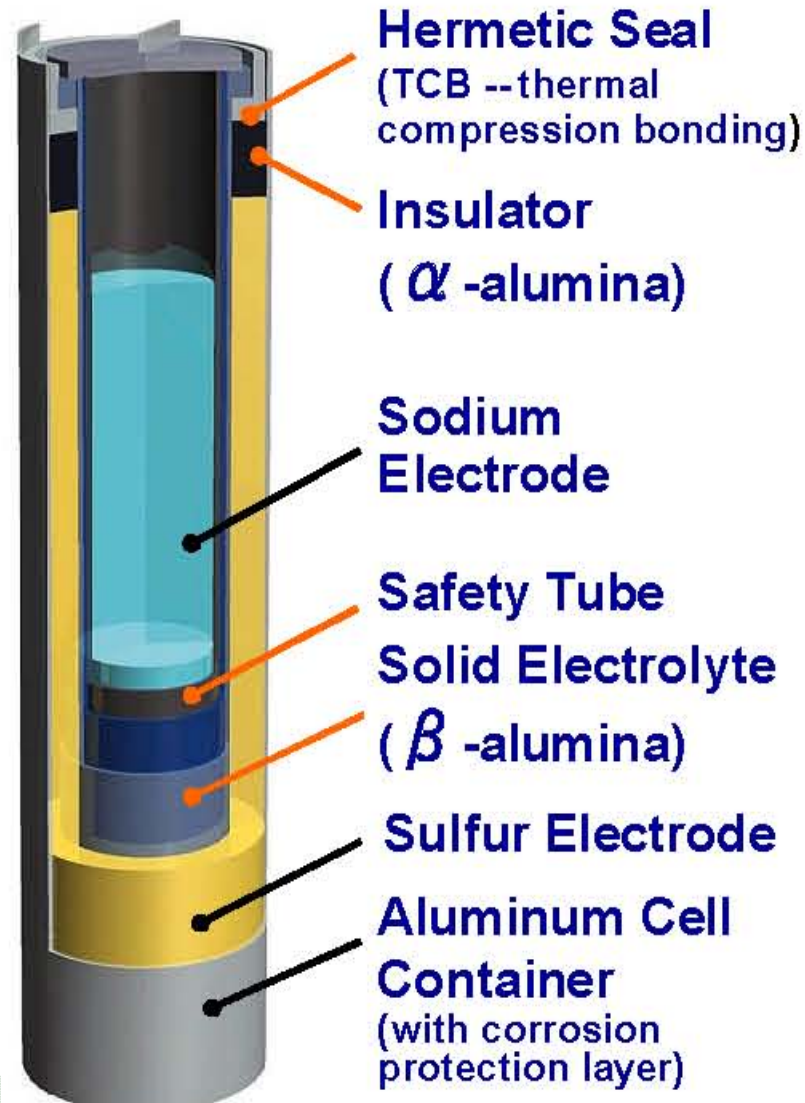


Robot Welding



500kW NAS

# NAS Cells – Sealed and Protected





# Extensive NAS Safety Testing : approved for in-building use in Japan



**Module Firing Test**



**Cell Burning Test**



**Module Crush Test**



**Module Drop Test**

# NAS is Cost Effective

- Tokyo Electric Power

“We have achieved the goal we set 25 years ago for NAS to be cost competitive with pumped storage”, and

NAS storage has much lower transmission costs than pumped storage because it can be located near the load.

- NAS has

4x to 6x the dispatchable capacity range vs. fossil plant

NAS has much faster response than fossil plant

And it is difficult to site fossil plants near the load where they are needed so transmission cost for fossil plants are higher.



# Renewables Integration using fossil fuels is not Clean

- ▶ Combustion turbine backup of wind reduces expected CO<sub>2</sub> savings by about 22% and expected NOX savings by 70% (CT can increase NOX by 240% to 600%) – Prof. Apt, CMU 2008
- ▶ Storage reduces CO<sub>2</sub> emissions for frequency regulation by 70% in California – KEMA
- ▶ Imports of renewables using fossil fuel backup are not clean – avoid export of California storage needs to out of state fossil fuels

# Storage should be deployed now at the Gigawatt scale

- ▶ Demand pull from large-scale deployment will encourage:
  - ▶ Investments in storage manufacturing
  - ▶ Lower costs through volume production
  - ▶ Promote commercialization of new clean storage technologies
- ▶ Studies and technology development should continue, but the time for commercial deployment is now

# California Electricity Storage Policy Agenda

- 1) Adjust California ISO markets to fully use and fairly compensate storage services ( work is in progress )
- 2) Clarify that clean storage is a DSM resource that is #2 in the loading order
- 3) Establish a portfolio standard of 5% of peak load by 2020 for storage that is
  - ▶ Clean ( no GHG emissions )
  - ▶ Fast ( less than 1 second response from full charge to full discharge), and
  - ▶ Deep ( greater than 6 hrs of storage )